Operative Versus Nonoperative Treatment Following First-Time Anterior Shoulder Dislocation

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Operative Versus Nonoperative Treatment Following First-Time Anterior Shoulder Dislocation

A Systematic Review and Meta-Analysis

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Abstract

Background: There is an ongoing debate about whether to perform operative or nonoperative treatment following a first-time anterior dislocation or wait for recurrence before operating. The aim of this systematic review is to compare recurrence rates following operative treatment following first-time anterior dislocation (OTFD) with recurrence rates following (1) nonoperative treatment (NTFD) or (2) operative treatment after recurrent anterior dislocation (OTRD).

Methods: A literature search was conducted by searching PubMed (Legacy), Embase/Ovid, Cochrane Database of Systematic Reviews/Wiley, Cochrane Central Register of Controlled Trials/Wiley, and Web of Science/Clarivate Analytics from 1990 to April 15, 2020, according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The revised tool to assess risk of bias in randomized trials (RoB 2) developed by Cochrane was used to determine bias in randomized controlled trials, and the methodological index for non-randomized studies (MINORS) was used to determine the methodological quality of non-randomized studies. The certainty of evidence was assessed with the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach using GRADEpro software.

Results: Of the 4,096 studies for which the titles were screened, 9 comparing OTFD and NTFD in a total of 533 patients and 6 comparing OTFD and OTRD in a total of 961 patients were included. There is high-quality evidence that OTFD is associated with a lower rate of recurrence (10%) at >10 years of follow-up compared with NTFD (55%) ($p < 0.0001$). There is very low-quality evidence that patients receiving OTFD had a lower recurrence rate (11%) compared with those receiving OTRD (17%) ($p < 0.0001$).

Conclusions: There is high-quality evidence showing a lower recurrence rate at >10 years following OTFD compared with NTFD (or sham surgery) in young patients. There is evidence that OTFD is more effective than OTRD, but that evidence is of very low quality.

Level of Evidence: Therapeutic Level III. See Instructions for Authors for a complete description of levels of evidence.

Anterior shoulder dislocations are frequently seen in trauma clinics, with a reported incidence of 23.9 per 100,000 person-years[1-3]. A shoulder dislocation may be accompanied by a variety of soft-tissue, bone, and cartilage lesions, and a Bankart lesion may be present in up to 85%

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of patients who have shoulder instability[4-6]. These lesions make the shoulder susceptible to recurrent dislocations following a first-time dislocation[7,8]. Other factors that are associated with recurrent dislocations are young age, male sex, and hyperlaxity[8]. Both operative and nonoperative treatments are available to treat a shoulder dislocation[9].

Reported recurrence rates following nonoperative treatment of a first-time dislocation (NTFD) are up to 94.5%[10]. Operative treatment for anterior shoulder instability consists of immobilization followed by a soft-tissue procedure, such as the Bankart repair, or an osseous augmentation procedure, such as the Latarjet procedure[11]. When little bone loss is present, (recurrent) shoulder dislocations are commonly treated with labral repair, with recurrence rates ranging from 8% to 30% at 10 years of follow-up[12,13]. Reported risk factors for failure of this procedure include young age (<22 years old), male sex, participation in competitive sports, the presence of glenoid bone loss or an engaging Hills-Sachs lesion, and prior dislocations[14-16]. The number of dislocations prior to surgery might influence the recurrence rates following operative treatment, possibly indicating that operative treatment following a first-time dislocation (OTFD) is preferable[17]. Reoperations due to instability symptoms are performed in 3% to 18% of patients following labral repair[12,13]. The Latarjet procedure is associated with a recurrent instability rate of 5.7% and 7.6% for open bone-block and arthroscopic bone-block surgery, respectively[18]. However, relatively high complication rates have been reported for open (7.2%) and arthroscopic (13.6%) bone-block procedures[18]. Unnecessary surgery should be avoided, and some patients benefit from nonoperative treatment. Greater tuberosity fractures and an age over 40 years decrease the likelihood of recurrence[8]. Surgery can have complications such as infection and nerve damage, so it should be avoided in patients who will not benefit from it[18]. There is an ongoing debate about whether to perform operative or nonoperative treatment for a first-time dislocation or to wait for recurrence before operating. It seems that OTFD is associated with less recurrence than operative treatment following recurrent dislocation (OTRD)[19]. However, an overview of evidence is still lacking.

The aim of this systematic review is to compare recurrence rates following OTFD with recurrence rates following NTFD or OTRD. It was hypothesized that OTFD would be associated with a lower recurrence rate compared with NTFD and OTRD.

Materials and Methods

Search Strategy

A review protocol was developed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (http://www.prisma-statement.org/) and was submitted to PROSPERO (https://www.crd.york.ac.uk/) under registration number CRD42020181900. Relevant studies were identified by searching PubMed (Legacy), Embase/Ovid, Cochrane Database of Systematic Reviews/Wiley, Cochrane Central Register of Controlled Trials/Wiley, and Web of Science/Clarivate Analytics from 1990 to April 15, 2020, by 3 authors (S.H.v.S., L.P.E.V., and S.P.-V.) (a clinical librarian). We chose 1990 as the start date because previous systematic reviews[20-23] had not included studies before 1994, and we limited the search to the last 30 years in order to include only the most recent study data. The following terms, including synonyms and closely related words, were used as index terms or free-text words: “shoulder,” “dislocation,” “surgery,” “conservative,” and “primary.” No language restrictions were applied to the search. Duplicate articles were excluded by the librarian (S.P.-V.) using EndNote X8. Our full search strategies are shown in the Appendix. Two authors (S.H.v.S. and L.P.E.V.) independently screened the title and abstract with Rayyan[24]. Any disagreement was resolved by discussion and consensus. Studies that met the inclusion criteria underwent full-text screening by the same authors (S.H.v.S. and L.P.E.V.).

Eligibility Criteria

Previous systematic reviews showed that a sufficient number of prospective studies comparing OTFD with NTFD are available[20-23]. Nonoperative treatment was defined as any treatment that did not repair or change anatomical structures, including arthroscopic washout (sham surgery). Randomized controlled trials and cohort studies with a prospective design comparing recurrence rates following OTFD and NTFD with a minimum mean follow-up of 2 years were included. Prospective and retrospective cohort studies comparing recurrence rates following OTFD to those following OTRD with a minimum mean follow-up of 2 years were included as well. Articles written in the English, Dutch, or German language were included. Studies that did not report original data; abstracts; and animal, cadaveric, and biomechanical studies were excluded. Studies reporting outcomes of revision surgery after any previous anterior shoulder stabilization procedure and studies in which patients received arthroplasty were excluded as well.

Data Extraction

Trial characteristics and patient characteristics were extracted. Baseline characteristics included the age at the time of surgery and the time between the first-time dislocation and surgery. The primary outcome was the recurrence rate following treatment. Secondary outcomes included functional outcome scores, such as the Rowe score, Western Ontario Shoulder Instability Index (WOSI), and Constant score; return to sports; and the need for another anterior shoulder stabilization procedure. Data extraction was performed by 2 authors (S.H.v.S. and L.P.E.V.). Any disagreement was resolved by discussion and consensus. If a secondary outcome, such as return to sports, was not reported in the study with the longest follow-up, it was extracted from the previous study of the same patient cohort if possible.

Methodological Quality and Certainty

The revised tool to assess risk of bias in randomized trials (RoB 2) developed by Cochrane was used to determine bias in randomized controlled trials[25]. The quality of the non-randomized studies was assessed by using the methodological index for non-randomized studies (MINORS) tool[26]. For the primary outcome, the certainty of the evidence was assessed with the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach using GRADEpro software (Evidence Prime Incorporation, McMaster University, Hamilton, Canada; https://gradepro.org)[27]. Two authors (S.H.v.S. and L.P.E.V.) independently assessed the methodological quality and certainty of the evidence. Any disagreement was resolved by discussion and consensus.

Statistical Analysis

Patient characteristics and follow-up were pooled by calculation of weighted means and pooled standard deviations (SDs). If the SD was not reported, it was estimated from the range and the sample size according to the method described by Walter and Yao[28]. If the mean was not reported, it was estimated using the median, range, and sample size according to the method described by Hozo et al.[29]. Proportions were compared using chi-square tests. Review Manager, version 5.3 (the Nordic Cochrane Center, Copenhagen, Denmark), was used to calculate mean differences and risk ratios (RRs) with the 95% confidence interval (CI). Random-effects models were used to account for possible heterogeneity. In addition, heterogeneity between studies was assessed using the chi-square and I^2 statistics. $I^2 > 50\%$ was considered to be substantial heterogeneity[30]. Meta-analyses of recurrence rates were conducted for studies with >2 years of follow-up and studies with >10 years of follow-up if possible.

Results

Screening and Study Characteristics

After duplications were removed, 4,096 titles and abstracts were screened (Fig. 1). Four thousand and fifty-seven articles were excluded, and 39 full-text articles were assessed. A total of 15 articles were included. Reasons for exclusion are listed in Figure 1. Four randomized controlled trials and 5 prospective cohort studies comprising a total of 533 patients compared OTFD (280 patients) with NTFD (253 patients) (Table I)[10,13,31-37]. The sample size ranged from 9 to 70 patients. The included studies were published between 1994 and 2020. The mean follow-up ranged from 1.9 to 14.2 years (Table I). Of the studies comparing OTFD with NTFD, 1 reported recurrence rates following an open labral repair and 8 reported recurrence rates following arthroscopic labral repair.

Five retrospective studies comprising 653 patients compared OTFD (227 patients) with OTRD (426 patients) after a labral repair. One study

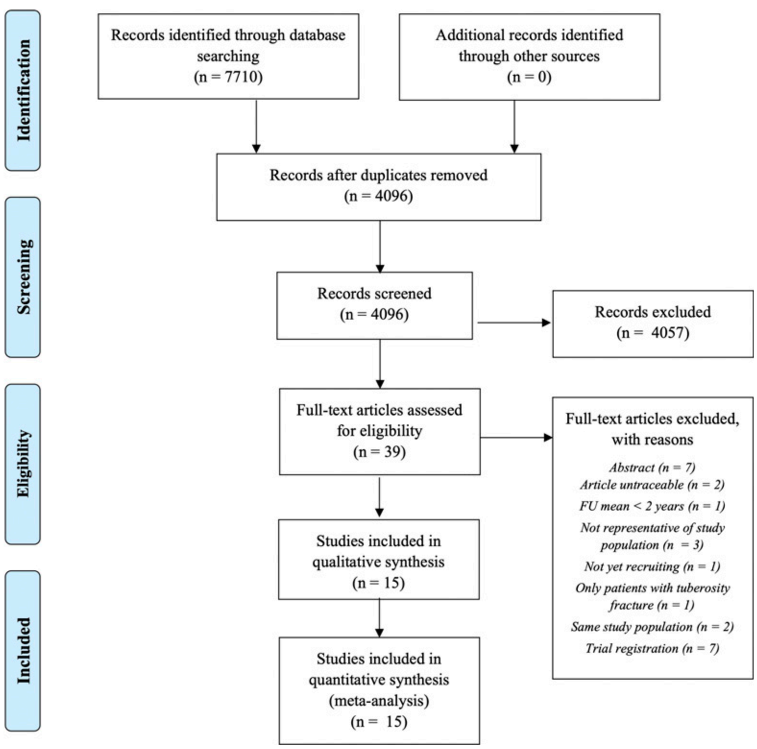

Fig. 1
PRISMA flow diagram. FU = follow-up.

TABLE I Characteristics of Studies of OTFD Versus NTFD*

Authors	Year	Level of Evidence	Design	Treatment (No. of Patients)		Sex	Mean Age (yr)		Mean Follow-up (yr)		Quality Assessment Score
				OTFD	NTFD		OTFD	NTFD	OTFD	NTFD	
Arciero et al.[31]	1994	II	P	LR (21)	15	M: unclear F: unclear	20.5	19.5	2.7	1.9	MINORS: 18
Larrain et al.[10]	2001	II	P	LR (28)	18	M: 94% F: 6%	21	21	5.6	5.6	MINORS: 17
Bottoni et al.[32]	2002	I	P/RCT	LR (9)	12	M: 100% F: 0%	21.6	23	2.9	3.1	RoB 2: high
Kirkley et al.[33]	2005	I	P/RCT	LR (16)	15	M: 87% F: 13%	23.3	22.7	6.6	6.6	RoB 2: some concerns
Jakobsen et al.[13]	2007	I	P/RCT	LR (36)	39	M: 82% F: 18%	23	20	10	10	RoB 2: some concerns
Shih et al.[37]	2011	II	P	LR (39)	25	M: unclear F: unclear	21.5	22.9	6.1	5.9	MINORS: 20
Gigis et al.[34]	2014	II	P	LR (38)	27	M: 63% F: 37%	16.7	16.7	3	3	MINORS: 17
De Carli et al.[35]	2019	II	P	LR (60)	70	M: 93% F: 7%	22.8	20.8	6.9	8.6	MINORS: 17
Yapp et al.[36]	2020	I	P/RCT	LR (33)	Lavage (32)	M: 92% F: 8%	24.7	23.8	14.2	14.2	RoB 2: low

*OTFD = operative treatment following first-time anterior dislocation, NTFD = nonoperative treatment following first-time anterior dislocation, P = prospective, RCT = randomized controlled trial, LR = labral repair, RoB 2 = revised Cochrane risk-of-bias tool for randomized trials (for RCT studies), and MINORS = methodological index for non-randomized studies.

comprising 308 patients compared OTFD (83 patients) with OTRD (225 patients) after a Latarjet procedure (Table II). The mean age of the patients receiving OTFD ranged from 19 to 27.6 years, and the mean age of the patients receiving OTRD ranged from 19.5 to 27.9 years. The mean follow-up ranged from 2 to 5.7 years.

TABLE II Characteristics of Studies of OTFD Versus OTRD*

Authors	Year	Level of Evidence	Design	No. of Patients		Sex	Mean Age (yr)		Mean Follow-up (yr)		Quality Assessment (MINORS) Score
				OTFD	OTRD		OTFD	OTRD	OTFD	OTRD	
Larrain et al.[39]	2006	II	R	LR (39)	LR (121)	M: 100% F: 0%	22	22	5.7	5.7	12
Kim et al.[38]	2011	II	R	LR (42)	LR (68)	M: 88% F: 12%	24.2	27.8	3.9	3.9	15
Shin et al.[40]	2016	II	R	LR (33)	LR (89)	M: 93% F: 7%	26.1	25.8	2.7	2.9	16
Marshall et al.[19]	2017	II	R	LR (68)	LR (53)	M: 88% F: 12%	19	19.5	4.2	4.3	15
Nakagawa et al.[55]	2020	II	R	LR (45)	LR (95)	M: 82% F: 18%	—	—	>2	>2	14
Hardy et al.[50]	2020	II	R	Latarjet (83)	Latarjet (225)	M: 85% F: 15%	27.6	27.9	3.6	3.3	15

*OTFD = operative treatment following first-time anterior dislocation, OTRD = operative treatment following recurrent anterior dislocations, R = retrospective, LR = labral repair, and MINORS = methodological index for non-randomized studies.

TABLE III GRADE Assessment*

Study Comparison	No. of Studies	Study Design	Certainty Assessment: Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	Recurrence Rate†: OTFD	NTFD or OTRD	Effect: Relative Risk (95% CI)	Absolute Risk (95% CI)	Certainty	Importance
OTFD vs. NTFD	2	Randomized controlled trials	Not serious	Not serious	Not serious	Not serious	None	7/69 (10.1%)	39/71 (54.9%)	0.19 (0.09-0.41)	445 (500-324) fewer per 1,000	High	Critical
OTFD vs. OTRD	5	Observational studies	Very serious	Not serious	Not serious	Not serious	None	27/ 227(11.9%)	73/426 (17.1%)	0.46 (0.32-0.67)	93 (117-57) fewer per 1,000	Very low	Critical

*OTFD = operative treatment following first-time anterior dislocation, NTFD = nonoperative treatment following first-time anterior dislocation, and OTRD = operative treatment following recurrent anterior dislocations. †Number of dislocations following treatment/total number of patients (%) at follow-up ranging from 10 to 16 years for OTFD versus NTFD and 2 to 9.8 years for OTFD versus OTRD.

Quality and GRADE Assessment

The MINORS score ranged from 17 to 20 in the studies comparing OTFD with NTFD. The RoB 2 ranged from low to high. In the studies of OTFD versus OTRD, the MINORS score ranged from 12 to 16. The GRADE assessment showed that the evidence derived from the comparisons of recurrence rates between OTFD with NTFD at a minimum 10-year follow-up was of high quality (Table III). There was very low-quality evidence from the comparisons of the recurrence rates between OTFD and OTRD.

Recurrence Rates

The pooled overall recurrence rates were significantly lower after OTFD compared with NTFD. Recurrence was reported in 30 (11%) of 280 patients in the OTFD group and in 178 (70%) of 253 patients in the NTFD group ($p < 0.0001$) (Table IV; see also Appendix Supplementary 2). A meta-analysis of the 2 studies with >10 years of follow-up showed that OTFD was associated with significantly less recurrence compared with NTFD ($p < 0.0001$) (Fig. 2)[13,36]. There was less recurrence in the patients in the OTFD group treated with labral repair (27 of 227; 12%) than in the patients in the OTRD group treated with labral repair (73 of 426; 17%) ($p < 0.0001$; Fig. 3). The relationship between the number of shoulder dislocations prior to surgery and recurrence rates following operative treatment could not be estimated. In the 1 study comparing recurrence rates between a Latarjet procedure following a first-time dislocation and a Latarjet procedure following recurrent dislocation, the recurrence rates were not significantly different between the 2 groups. Patients who underwent the Latarjet procedure following a first-time dislocation had a 4.8% recurrence rate, compared with 3.6% in those who had the Latarjet procedure following recurrent dislocation (Table IV).

Functional Outcome

Four studies that compared OTFD with NTFD described the functional outcome using the Rowe score. The average Rowe score for patients treated operatively was higher than that for patients treated nonoperatively (see Appendix Supplementary 3). However, there was a substantial heterogeneity ($I^2 = 99\%$) and the difference was not significant ($p = 0.27$). The WOSI score was reported in 3 studies[33,35,36]. Two studies used the median Disabilities of the Arm, Shoulder and Hand (DASH) score[33,36]. The L'Insalata score and Oxford shoulder score were used in 1 study[32] and the Single Assessment Numeric Evaluation (SANE) score was used in another[13] (Table IV).

Three studies comparing OTFD with OTRD described the functional outcome using the Rowe score[38-40]. A meta-analysis showed a significantly lower Rowe score in the OTRD group ($p = 0.02$) (see Appendix Supplementary 4)[38,40]. One study compared the Walch-Duplay score after a Latarjet procedure following a first-time dislocation and a Latarjet procedure following recurrent dislocation. Patients who had the Latarjet procedure following a first-time dislocation had a score of 67.3 ± 24.85, compared with 71.8 ± 25.1 in the other group; this difference was not significant ($p = 0.20$).

Return to Sports

Return to sports was reported in 3 studies comparing OTFD with NTFD. The overall percentage of patients returning to sports was higher in the OTFD group (84%) compared with the NTFD group (74%), but no significant difference was observed ($p = 0.18$; see Appendix Supplementary 5). However, the percentage of patients returning to sports at their preinjury level was significantly higher in the OTFD group (73%) compared with the NTFD group (48%) ($p < 0.0001$; see Appendix Supplementary 6). Two studies comparing OTFD with OTRD reported return to sports. Seventy-one (97%) of 73 patients who underwent OTFD returned to sports, whereas 148 (86%) of 173 patients treated for recurrent shoulder dislocations returned to sports at their preinjury level. The return-to-sports rate was significantly lower in the OTRD group ($p = 0.01$; see Appendix Supplementary 7).

Need for Additional Surgery

The need for additional surgery was reported in 6 studies comparing OTFD with NTFD. Twelve (6%) of 198 patients in the OTFD group and 92 (48%) of 193 patients in the NTFD group needed additional surgery. The meta-analysis showed that the rate of additional surgery was significantly lower in the OTFD group than in the NTFD group ($p < 0.0001$; see Appendix Supplementary 8). Two studies comparing OTFD using labral repair

TABLE IV Functional Outcome Scores

Authors*	Treatment (No. of Patients)	Recurrence Rate†	Functional Outcome Score 1	Functional Outcome Score 2	Return to Sports†	Additional Surgery†
OTFD vs. NTFD						
Arciero et al.[31] (1994)	LR (21) vs. NTFD (15)	OTFD: 3/21 (14%) NTFD: 12/15 (80%)	Rowe score OTFD: 16 excellent, 2 good, 3 poor	—	OTFD: 19/21 (90%) NTFD: —	OTFD: 1/21 (5%) NTFD: 7/15 (47%)
Larrain et al.[10] (2001)	LR (28) vs. NTFD (18)	OTFD: 1/28 (4%) NTFD: 17/18 (94%)	Rowe score OTFD: 25 excellent, 2 good, 0 fair, 1 poor NTFD: 1 excellent, 0 good, 0 fair, 17 poor	—	—	—
Bottoni et al.[32] (2002)	LR (9) vs. NTFD (12)	OTFD: 1/9 (11%) NTFD: 9/12 (75%)	SANE score‡ OTFD: 88 (60-100), $p < 0.002$ NTFD: 57 (46-98), $p < 0.002$	L'Insalata score‡ OTFD: 94 (65-98), $p < 0.002$ NTFD: 73 (46-92), $p < 0.002$		OTFD: 1/9 (11%) NTFD: 6/12 (50%)
Kirkley et al.[33] (2005)	LR (16) vs. NTFD (15)	OTFD: 3/16 (19%) NTFD: 9/15 (60%)	WOSI score‡ OTFD: 86.3% ($p = 0.17$) NTFD: 74.8% ($p = 0.17$)	DASH score‡ OTFD: 95.8% ($p = 0.57$) NTFD: 94.1% ($p = 0.57$)	—	—
Jakobsen et al.[13] (2007)	LR (36) vs. NTFD (39)	OTFD: 3/36 (8%) NTFD: 24/39 (62%)	Oxford shoulder score OTFD: 72% good or excellent NTFD: 74% unsatisfactory	—	—	OTFD: 1/36 (3%) NTFD: 19/39 (49%)
Shih et al.[37] (2011)	LR (39) vs. NTFD (25)	OTFD: 2/39 (5%) NTFD: 23/25 (92%)	—	—	—	OTFD: 2/39 (5.1%) NTFD: 19/25 (76%)
Gigis et al.[34] (2014)	LR (38) vs. NTFD (27)	OTFD: 5/38 (13%) NTFD: 19/27 (70%)	Rowe score‡ OTFD: 85% NTFD: 84%	—	OTFD: 25/38 (66%) NTFD: 15/27 (56%)	OTFD: 5/38 (13%) NTFD: —
De Carli et al.[35] (2019)	LR (60) vs. NTFD (70)	OTFD: 8/60 (13.3%) NTFD: 50/70 (71%)	Rowe score§ OTFD: 94.2 ± 5.3 NTFD: 75.3 ± 5.5	WOSI score§ OTFD: 94.5 ± 4.0 NTFD: 76.5 ± 5.2	OTFD: 56/60 (93.3%) NTFD: 62/70 (88.6%)	OTFD: 4/60 (7%) NTFD: 32/70 (46%)
Yapp et al.[36] (2020)	LR (33) vs. lavage (32)	OTFD: 4/33 (12%) NTFD: 15/32 (47%)	WOSI score# OTFD: 7.1 (1.4-22.8) NTFD: 13.5 (5.8-45.3)	DASH score# OTFD: 0 (0-2.3) NTFD: 2.3 (3.7-9.6)	OTFD: 28/32 (88%) NTFD: 19/33 (58%)	OTFD: 3/33 (9%) NTFD: 9/32 (28%)
OTFD vs. OTRD						
Larrain et al.[39] (2006)	LR: OTFD (39) vs. LR: OTRD (121)	OTFD: 2/39 (5%) OTRD: 10/121 (8%)	Rowe score OTFD: 33 excellent, 4 good, 0 fair, 2 poor OTRD: 105 excellent, 6 good, 0 fair, 10 poor		OTFD: 39/39 (100%) OTRD: 102/121 (84%)	—
Kim et al.[38] (2011)	LR: OTFD (42) vs. LR: OTRD (68)	OTFD: 1/42 (2%) OTRD: 2/68 (3%)	Constant score‡ OTFD: 94 (62-100) OTRD: 88 (58-100)	Rowe score‡ OTFD: 91 (63-97) OTRD: 88 (52-98)	OTFD: 32/34 (94%) OTRD: 46/52 (88%)	—

continued

TABLE IV *(continued)*

Authors*	Treatment (No. of Patients)	Recurrence Rate†	Functional Outcome Score 1	Functional Outcome Score 2	Return to Sports†	Additional Surgery†
Shin et al.[40] (2016)	LR: OTFD (33) vs. LR: OTRD (89)	OTFD: 1/33 (3%) OTRD: 6/89 (7%)	Rowe score§ OTFD: 90.8 ± 9.3 OTRD: 87.3 ± 12.9	ASES score§ OTFD: 93.5 ± 6.9 OTRD: 91.3 ± 7.5	—	OTFD: 1/33 (3%) OTRD: 6/89 (7%)
Marshall et al.[19] (2017)	LR: OTFD (68) vs. LR: OTRD (53)	OTFD: 20/68 (29%) OTRD: 33/53 (62%)	—	—	—	OTFD: 5/68 (7%) OTRD: 17/53 (32%)
Nakagawa et al.[55] (2020)	LR: OTFD (45) vs. LR: OTRD (95)	OTFD: 3/45 (7%) OTRD: 22/95 (23%)	—	—	—	—
Hardy et al.[50] (2020)	Latarjet: OTFD (83) vs. Latarjet: OTRD (225)	OTFD: 4/83 (5%) OTRD: 8/225 (4%)	Walch-Duplay score§ OTFD: 67.3 ± 24.8 OTRD: 71.8 ± 25.1	—	—	OTFD: 5/83 (6%) OTRD: 9/225 (4%)

*OTFD = operative treatment following first-time anterior dislocation, NTFD = nonoperative treatment following first-time anterior dislocation, OTRD = operative treatment following recurrent anterior dislocations, and LR = labral repair. †Number/total (%). ‡Mean with or without the range in parentheses. §Mean ± standard deviation. #Median with the interquartile range in parentheses.

with OTRD using labral repair reported on the need for additional surgery. Six (6%) of 101 patients underwent additional surgery in the OTFD group, and 23 (16%) of 142 patients needed additional surgery in the OTRD group. The meta-analysis showed that the OTFD group had a significantly lower rate of additional surgery than the OTRD group ($p = 0.002$; see Appendix Supplementary 9).

One study reported on the need for additional surgery after a Latarjet procedure following a first-time dislocation compared with a Latarjet procedure following recurrent dislocation. Five (6%) of 83 patients who underwent the Latarjet procedure following a first-time dislocation had additional surgery, whereas 9 (4%) of 225 who underwent the Latarjet procedure following recurrent dislocation had additional surgery. No significant difference was found between the groups ($p = 0.5$).

Discussion

Our most important findings were that (1) there is high-quality evidence showing a lower recurrence rate after operative treatment of a first-time anterior dislocation (OTFD) compared with nonoperative treatment of a first-time anterior shoulder dislocation (NTFD) in young patients at long-term follow-up and (2) there is evidence that OTFD with arthroscopic labral repair is more effective than arthroscopic labral repair carried out after a recurrent dislocation but that evidence is of very low quality. There was no difference in the rate of return to sports at any level between OTFD and NTFD or between OTFD and operative treatment of a recurrent anterior dislocation (OTRD). Some patients need more than 6 months for a successful return to sports and this could explain why a difference was not observed. However, patients receiving OTFD did show a higher return to their preinjury level of sports compared with the NTFD group. Recurrence rates do not correlate with successful return to sports. The shoulder may be stable enough for patients to return to sports at their preinjury level or at a lower level within 6 months but not stable enough to prevent recurrence within 2 to 14 years after a traumatic event.

The rate of additional surgery was lower after OTFD than after NTFD. The definition of recurrent instability may have influenced the reported recurrence rates as well as the surgeon's decision to recommend additional surgery. Also, patients who received operative treatment might have been more reluctant to undergo additional surgery after recurrence. The lack of consensus with regard to the definition of recurrent instability has been previously reported, and thorough reporting of the specific type of instability as recurrent dislocation, subluxation, or apprehension seems therefore warranted[41]. The availability of materials as well as the expertise and number of surgeons able to perform this operation may have influenced the decision of whether patients should receive operative or nonoperative treatment in the non-randomized controlled studies.

Hutyra et al. showed that only 29% of patients received proper evidence-based information regarding treatment for first-time anterior shoulder dislocation[42]. The current study revealed that there is high-quality evidence showing beneficial outcomes for young patients following OTFD. Clinicians should acknowledge the importance of providing evidence-based information to assist patients in decision-making. Patients' expectations are generally high

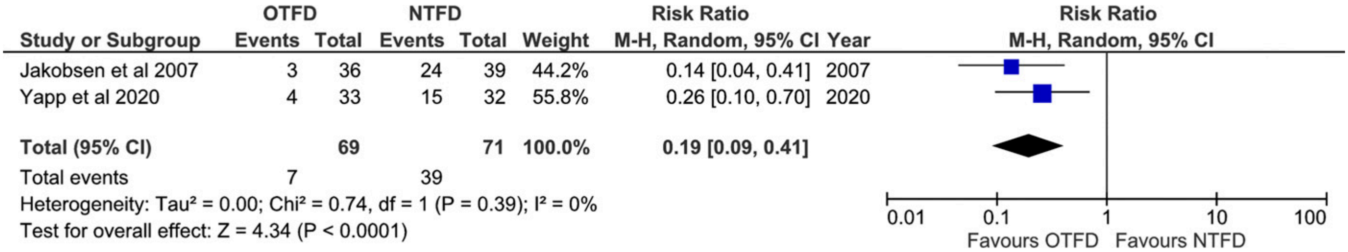

Fig. 2

Recurrence at >10 years following operative treatment (OTFD) versus nonoperative treatment (NTFD) of first-time dislocations. M-H = Mantel-Haenszel, df = degrees of freedom.

regarding being able to return to sports (92%) and not having recurrent shoulder instability (79%), which may negatively influence postoperative rates of satisfactory outcomes[43]. However, it is unclear what information the patients received preoperatively. A survey completed by the patient before consultation might help a surgeon to refine patients' expectations.

Patients treated with a labral repair following a first-time dislocation have a recurrence rate of 10% at 10 years based on current data. Reported risk factors for recurrence after primary arthroscopic labral repair include young age (<22 years), male sex, <3 suture anchors, technical errors such as poor anchor positioning and inappropriate depth of knotless anchors, and competitive sports[16]. Patients treated with NTFD do not benefit from immobilization for >1 week[44]. This might be different for shoulder dislocations treated operatively, as the surgical repair needs time to heal. According to the consensus rehabilitation guidelines following arthroscopic anterior capsulolabral repair of the shoulder developed by the American Society of Shoulder and Elbow Therapists (ASSET), there should be a 0- to 4-week period of absolute immobilization followed by gradually increasing movement of the shoulder joint and reaching an almost full range of motion after 12 weeks postoperatively[45]. However, sufficient evidence on this rehabilitation protocol is lacking[46]. Patients with an anterior labroligamentous periosteal sleeve avulsion and osseous Bankart lesions have a higher recurrence rate after a labral repair compared with patients without these lesions[16,47]. Also, bone loss of >13.5% at a first-time dislocation results in a higher WOSI score, which is also associated with recurrent shoulder instability[47,48]. However, this outcome was investigated in a specific population, namely military personnel, and may be different in the general population. Another predictor of recurrence after primary shoulder dislocation is a positive apprehension test, which is more frequently seen in patients with recurrent dislocation[40,49]. Hardy et al. showed a recurrence rate of 4.8% in patients treated with a Latarjet procedure following a first-time dislocation[50]. This percentage is lower than that observed following labral repair; however, labral repair is cost-effective and the Latarjet procedure has a 10-fold higher complication rate compared with the labral repair[18,50,51]. Labral repair may be combined with remplissage, which might decrease the recurrence rates. However, it has been shown that adding remplissage to labral repairs might decrease the range of motion (external rotation) of the shoulder[52].

Patients who received NTFD showed an average recurrence rate of 55% after >10 years of follow-up[13,36]. Operative treatment might have been beneficial for this patient group. However, a weighted average of 45% of patients did not experience recurrence and therefore did not need operative treatment. To identify patients who may benefit from operative treatment, risk factors that predispose to recurrent instability following a first-time dislocation have been determined. There is high-quality evidence that an age under

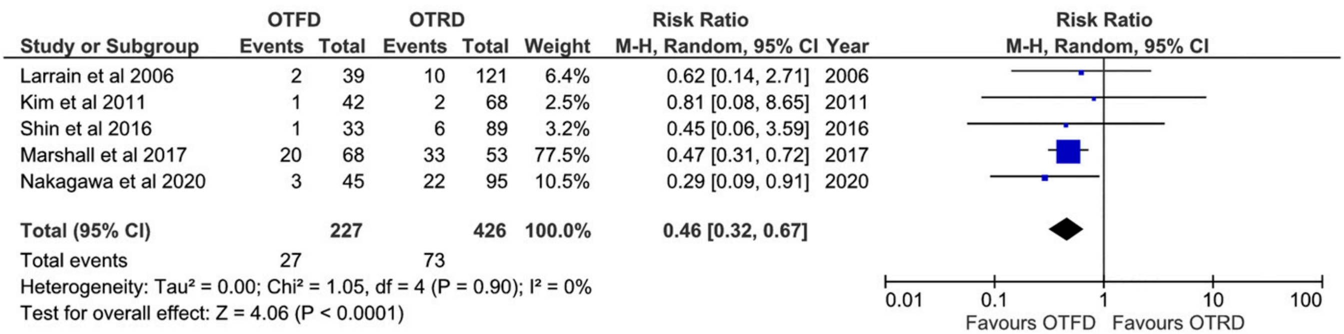

Fig. 3

Recurrence after operative treatment following a first-time dislocation (OTFD) versus operative treatment following recurrent dislocation (OTRD). M-H = Mantel-Haenszel, df = degrees of freedom.

40 years (13 times more likely), male sex (3 times more likely), and hyperlaxity defined as a Beighton score of >5 (3 times more likely) are factors that increase the risk of recurrent instability[8]. In addition, there is low-quality evidence that osseous Bankart lesions, certain occupations, Hill-Sachs lesions, physiotherapy, and nerve palsy are associated with recurrent instability[8]. There is high-quality evidence that patients with a greater tuberosity fracture are 7 times less likely to experience recurrent instability[8]. These factors can be valuable in determining whether patients should receive operative or nonoperative treatment.

Patients who underwent OTRD with arthroscopic labral repair showed recurrence rates ranging from 7% to 62%, while the rates for those treated with OTFD ranged from 3% to 29%. Even though the recurrence rates following operative treatment are still quite high, operative treatment should be considered as the complication rates are low (1.6% for arthroscopic labral repair) and multiple dislocations are associated with increases in osseous lesions, the risk of recurrence after labral repair surgery, and the need for revision surgery[5,16]. Anterior glenoid erosion, anterior labral periosteal sleeve avulsion, and glenoid labral articular disruption are more often seen in patients with recurrent dislocation and may explain the higher recurrence rates[40,53]. No significant difference in recurrence was found between Latarjet procedures performed after a first-time dislocation and those performed after recurrent dislocation[50]. Also, the pain visual analog scale (VAS) scores were reported to be higher after OTFD than OTRD[50].

Crall et al. collected data on expenses related to OTFD and NTFD over a period of 15 years and found that OTFD is more cost-effective in young patients[54]. However, arthroscopic treatment for a first-time anterior dislocation was more expensive in 25-year-old women and all patients 35 years of age[54]. Operative treatment was less expensive than nonoperative treatment for all patients with a recurrent shoulder dislocation[54]. The average extra costs of nonoperative treatment compared with operative treatment for 25-year-old and 15-year-old males were $2,894 and $17, 824, respectively[54].

In a recent systematic review and meta-analysis, Hurley et al. reported that arthroscopic Bankart repair resulted in a significantly lower recurrence rate compared with nonoperative treatment for first-time traumatic anterior shoulder instability[23]. However, the current systematic review provided high-quality evidence with ≥10 years follow-up. Also, Hurley et al. found a difference in return to sports (92.8% versus 80.8% [$p = 0.002$] for arthroscopic Bankart repair and nonoperative treatment, respectively). They analyzed non-events, defined as events that did not occur, with a fixed-effects model whereas we used a random-effects model. The use of a fixed-effects model might overestimate the number of patients returning to sports. Also, they did not compare OTFD with OTRD[23].

As high-quality evidence showed a lower recurrence rate after OTFD compared with NTFD in young patients (15 to 39 years of age), we recommend considering OTFD for this patient group. In 10 years, 38% to 53% of the patients in the NTFD group did not experience a redislocation[13,36]. Risk factors for recurrent instability are known and might help to identify which patients may benefit from either nonoperative or operative treatment. Patients with severe soft-tissue lesions and osseous Bankart lesions have a higher recurrence rate after labral repair[16,47]. Additional research is needed to investigate if these patients would benefit more from a Latarjet procedure than from a labral repair.

Strengths of the current study include performing a thorough and systematic search following PRISMA guidelines and providing high-quality evidence with >10 years of follow-up for the comparison of OTFD and NTFD. In addition, studies were assessed using the RoB 2 and MINORS criteria to determine methodological quality and a GRADE analysis was performed to determine the certainty of the evidence. Due to sufficient homogeneity, a meta-analysis was feasible for both comparisons. Limitations include the fact that only low-quality retrospective studies could be included for the comparison of OTFD with OTRD. The duration of follow-up was relatively short in these studies.

Selection bias might be a major limitation of the retrospective studies used to compare OTFD with OTRD. Since the considerations used to choose either OTFD or OTRD were unclear, a selection bias may be present. Another limitation is that the effect of the specific number of preoperative dislocations on recurrence rates following operative treatment could not be determined. Future research focusing on the relationship between the number of shoulder dislocations prior to surgery and recurrence rates after surgery could result in more specific patient management. As only low-quality evidence was available, future research should include prospective study designs to determine recurrence rates after OTFD or OTRD.

Conclusions

There is high-quality evidence showing a lower recurrence rate at >10 years following OTFD compared with NTFD (or sham surgery) in young patients. There is evidence that OTFD is more effective than OTRD; however, this evidence is of very low quality.

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Appendix

Supporting material provided by the authors is posted with the online version of this article as a data supplement at jbjs.org (http://links.lww.com/JBJSREV/A758).

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